

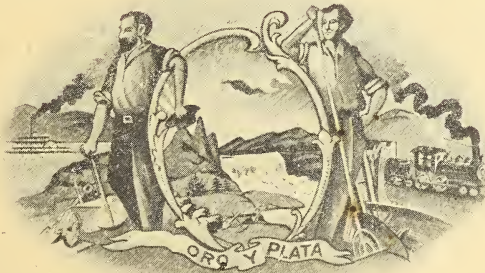
EIGHTH BIENNIAL
REPORT

— OF THE —

STATE ENGINEER

— AND OF THE —

Carey Land Act Board



— OF THE —

STATE OF MONTANA

1917-1918

A. W. MAHON, STATE ENGINEER

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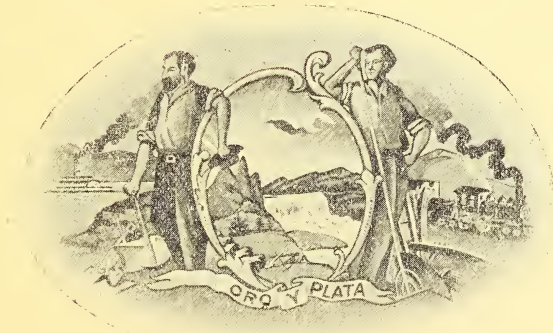
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Eighth Biennial Report of the State Engineer.

Helena, Montana, November 30th, 1918.

To His Excellency,
Hon. Samuel V. Stewart,
Governor of Montana.

Sir:

I have the honor to submit herewith, the Eighth Biennial Report of the State Engineer.

The report of the Carey Land Act Board, of which the State Engineer is ex-officio Secretary and Supervising Engineer, will be attached to and made part of this report as its interests are closely interwoven with the duties of this office.

Other duties of this office have consisted of routine work performed with the exception of the subjects herein noted.

MILITARY RECONNAISSANCE.

Early in the Spring of 1917, the War Department required the State of Montana to furnish a Military Reconnaissance of the State in co-operation with the U. S. Forest Service, which would assume the burden of furnishing this information in all sections embodying Forest Reserves. War having just been declared by this Country and the necessity of this work being represented by the War Department as extremely urgent, I was ordered by Your Excellency to assume charge of the work and give it precedence over all other duties which were not absolutely essential. I was likewise authorized by the State Board of Examiners to utilize any monies appropriated for this office that might be necessary to carry out the requirements of the War Department.

This military information was to be furnished in complete triplicate reports and maps for each single quadrangle of fifteen minutes of latitude by fifteen minutes of longitude or double quadrangles of fifteen minutes of latitude by thirty minutes of longitude over the entire area of the State and comprised the following information:

Brief Outline of Military Information Required for Each Quadrangle. Geography.

1. Location by latitude and longitude.
2. Topography.
 - Mountains and hills.
 - Streams.
 - Swamps.
 - Aeroplane landings.
 - Observation points.
3. Climatic Data.
 - Seasons.
 - Precipitation.
 - Temperature.
4. Health.

Military Features.

1. Points of Special Vulnerability.
2. Defensive Positions.

Transportation.

1. Routes.
 - Roads.
 - Bridges.
 - Ferries.
 - Fords.
 - Camp Sites.
 - Trails.
 - Railroads.
2. Facilities.
 - Aeroplanes.
 - Automobiles.
 - Draft Animals.
 - Guides.
 - Mounts.
 - Pack Animals.
 - Stage Lines.
 - Wagon Transportation.

Communication.

1. Radio Lines or Wireless Plants.
2. Telephone Lines.
3. Telegraph Lines.

Supplies and Resources.

1. Agricultural.
2. Forage.
3. Forests.
4. Fuel.
5. Meat Supplies.
6. Mines and Minerals.
7. Water.

Industrial Concerns.

1. Of all kinds.

Cities, Towns and Population.

1. Buildings.
2. Cities and Towns.
3. Educational Institutions.
4. Inhabitants.
5. Laborers.

No great flight of imagination is required to realize the vast amount of work and mass of information this simple list entails when worked out and compiled in detail and as the State was required to furnish this data at its own expense, it at once became apparent that the funds at the disposal of this office were no more than enough for the supervision of the work and final correction and compilation of the reports before transmitting them to the Engineers of the War Department. This necessitated the formulation of a plan for securing the information in the field, there being no State funds available for the purpose, and the County Commissioners outside the Forestry districts were called upon, with the approval of the Governor, as a patriotic duty and a military necessity, to appoint some qualified person, preferably the County Surveyor, to gather this information under our supervision and submit it to this office in as nearly the required form as possible, when the final compilation would be made by this office. All Counties responded by making the appointment requested and many of the Counties have either sent us all or part of the reports required, while others have been accumulating the information for their reports and have them well started. Only one County has failed to make an effort to assist in this work.

While we necessarily assumed supervision of this work, we at all times kept in consultation with the Adjutant General of Montana, because of its military and State character, and we likewise necessarily placed ourselves under the supervision of the Department Engineer of the Western Department of the United States Army, under whose direction we have proceeded in all matters pertaining to this work.

Enquiry as to the necessity of continuing this compilation since hostilities ceased has brought prompt reply that the completion of this work is, for good and sufficient reason, just as necessary as before, and that the War Department deems the information furnished by people familiar with local

conditions to be equally important. I am advised that this work is being taken up under State control all over the Country and that in every instance the State has assumed the burden of the expense in one form or another.

While my estimates for this Office for the coming biennial period have not included any sum for possible field work to complete the compilation of this information, yet we are assured of so nearly a complete reconnaissance that I deem it advisable to make some provision for a fund, which will be available in case of emergency, to assure the final completion of the work in this State, as the maps compiled from these reports will be supplied to the Adjutant General and this information available in his office will prove as valuable to Montana as to the War Department.

STREAM MEASUREMENTS AND HYDROGRAPHIC WORK.

The work of keeping up the records of stream flow in the State has been carried on by this Office in co-operation with the Water Resources Branch of the United States Geological Survey, though owing to the War, their operations have been limited on account of lack of qualified hydrographers and ours have necessarily been confined to a minimum on account of this Military Reconnaissance being carried on without additional field force or funds, but no gaging station under State control has been abandoned on that account.

Records at all State gaging stations have been carried on complete but with much less supervision and fewer ratings from this office than would be advisable under ordinary conditions.

While war conditions have handicapped the field work on our stream measurements, it has also limited the computations of flow to such an extent that no effort will be made to publish them in this report as has been the custom. Full data of flow, however, may be had for any station upon application.

This office has, during the past few years, endeavored to keep up the record of water right filings made in the several counties, so that we could furnish this information for any stream in the State upon application. This work has also been affected by our war work so that for the past two years we have been able to gather and compile the filings from only about seventy-five per cent of the Counties. This work will be brought up to date at the earliest possible opportunity.

Precipitation records for Montana may be had upon application here or to the U. S. Weather Bureau, but will not be published in the report of this office until accompanied by the corresponding period of stream flow.

RECOMMENDATIONS.

With the advent of the reconstruction period after the war and the general policy of placing as much land under irrigation as possible for the benefit of returning soldiers, the importance of irrigation, from every available source, is bound to impress itself upon our people and command more serious consideration every year.

To provide adequate records upon which to base a reliable estimate of available water supply for any proposed irrigation project, it is advisable to have the known stream flow for at least seven years.

With this fact in mind and the further realization of the very limited number of streams actually recorded in this State I cannot too earnestly urge the necessity of enlarging on this most important work for the development of our agricultural resources and I therefore recommend that not less than \$12,500.00 be appropriated for the year, 1919, and \$13,500.00 be provided for the year, 1920, for the purpose of Stream Measurements and other Hydrographic work.

With such a view of increasing and developing our irrigable lands in mind, I also call to your attention the very great importance of changing our water right laws to embody a system of records and regulations in harmony with the laws of our neighboring States, which will unquestionably prove advantageous to the conservation of our water and the development of our irrigable resources as it has in these neighboring commonwealths.

Respectfully submitted,

A. W. MAHON, State Engineer.

REPORT OF THE CAREY LAND ACT BOARD

OF THE STATE OF MONTANA

for the

YEARS 1917-1918.

A. W. MAHON, State Engineer, Secretary.

The Carey Land Act Board, during the past two years has been composed of Governor S. V. Stewart, Chairman; Attorney General S. C. Ford, and Secretary of State C. T. Stewart. A. W. Mahon, State Engineer, is ex-officio Secretary and Supervising Engineer of the Board, and G. R. Davies, Assistant Secretary.

The two last fiscal years have been the most prosperous ones since the State took advantage of the offer of the Federal Government in accepting any part of 1,000,000 acres of arid land available under the Carey Land law, provided the State complied with the Federal Regulations in the reclamation and settlement of such arid land.

At the present time the land segregated to the State under the Carey Land Act amounts to 172,486.22 acres of which 73,468.21 acres have been taken up by settlers.

The biennial period of 1917 and 1918 marks the consummation of the efforts put forth in the administration of the Carey Land Act Board to make this law a success and shows a real appreciation for irrigated lands offered under the Carey Act Projects as conducted in Montana, 24,030.49 acres having been sold under the supervision of this Board during these two years, and it is no little satisfaction to note that in many instances these purchases have been made by settlers who had previously bought land under the projects and this in itself speaks plainer than words in behalf of this law and its administration in Montana.

Under the old "Arid Land Grant Commission" a liability was incurred against the administration of Carey Land Act Law and the Montana law was properly changed to correct early mistakes and the Carey Land Act

Board was created. Since this Board assumed control of the administration of the Carey Land Act law in this State, it has always been self supporting but has never been able, heretofore, to materially reduce the indebtedness incurred by the old "Arid Land Grant Commission." During the past two years, however, the Carey Land Act Board has not only been able to defray all expense of administration but has also been able to pay off \$12,387.91 of the old indebtedness above referred to, much to the surprise and satisfaction of the holders of these old warrants, with a substantial balance on hand with which to make another call for warrants on this old debt.

We herewith give statement of the several projects as submitted to this office as of date October 31st, 1918, with such additional facts as deemed of sufficient interest for publication.

BILLINGS PROJECT.

This project includes 13,223.54 acres of Carey Act Land of which 10,859.62 acres have been sold. During the past two years 666.74 acres have been sold under this Project, the amount received therefrom by this Board being \$1,355.23.

The total acreage patented to the State under this Project is 13,223.54 acres and the amount patented by the State to settlers is 8,194.66 acres.

This Project is commonly known as the "Billings Bench" and lies principally northeast of the City of Billings.

The Billings Land & Irrigation Company, which is the contracting company with the State for the reclamation of this Project, is still in the hands of the Merchants Loan Company as Trustee. This Trustee is continuing the arrangement with the settlers, under the name of the Billings Bench Water Association, to maintain, operate and improve the canal as required by the State. The Carey Land Act Board cannot officially recognize this Association, however, until the canal system is made adequate and of capacity to fulfill the requirements of the State and until that time, this Board holds the Billings Land & Irrigation Company and its bondsmen responsible for the faithful fulfillment of their contract. This past year much reconstruction and improvements have been made on the Canal system and owing to unprecedented floods in the Yellowstone River during the past season, much river protection work above, below and at the headworks has become necessary and the work is in progress at this time. Measurements of the water running through the Canals of this Project are continued by the State Engineer pending the final acceptance of the system.

Much improvement work is proposed for the coming year and this Carey Land Project promises well to become one of the garden spots of the State.

The following statement is submitted by the trustees of the Company:

ITEMIZED DESCRIPTIVE STATEMENT BY THE COMPANY.

Name of Project: Billings Bench.

Name of Company: Billings Land & Irrigation Company.

Post Office Address: Billings, Montana.

County in which lands are situated: Yellowstone.

Description of Location:

Altitude: 3,000 feet.

Topography: Bench land, crossed by 5 creeks, generally smooth sloping North and East.

Soil: Sandy loam and clay loam.

Description of Water Supply:

Stream or streams from which water supply is obtained: Yellowstone River.

Whether running water, flood water, or both: Running.

Number of Reservoirs with area and capacity of each: One is projected: Area 215.73 acres, capacity 1,700 acre feet.

Water otherwise appropriated on stream: Supply is so large that other appropriations need not be considered.

Canal leading from stream to land or reservoir: Length 61 miles; capacity at head, 360 cu. feet per second.

Length of main laterals completed: 100 miles.

Length of main laterals to be built: None.

Length of distributing laterals completed: Included in main laterals.

Length of distributing laterals to be built: Included in main laterals.

Total length of canals and laterals completed: 161 miles.

Total length of canals and laterals to be completed: None.

General Description of Project:

Gravity system, following contour of valley on uniform grade.

Number and character of structures: Concrete headgate, 8 flumes, wood, aggregating 1900 feet, wooden stave iron banded pipe siphons, about 2,850 feet.

Engineering Difficulties: One tunnel 1847 feet long through solid rock and about 4,000 feet rock cut. It has been necessary to timber about 500 feet of the tunnel.

Total estimated cost of project: \$500,000.00.

Total expenditures to Oct. 31, 1918: \$496,698.77.

Price of water right per acre for lands owned by the Company: Price of land and water right from \$50 to \$65 an acre.

Price of water right per acre for other than Company and Carey Act Lands: From \$30 to \$35 an acre.

Terms of payment on water contracts: One-fourth cash, balance, ten annual payments.

Total number of acres within boundaries of project: 34,000.

Total number of acres susceptible of irrigation for:

Carey: 11,000.

Company Deeded: 11,000.

Private: 3,000.

State: 1,000.

Total number of acres to be actually irrigated by project: 26,000.

What necessities for drainage system have arisen: A few cases of seepage from canal and excess irrigation in localities where there is shale formation.

What character of drainage has been adopted and to what extent in actual construction: Two complete sub-surface drains (box) have been completed, one 13,500 feet long and one 12,000 feet long. These built under two drainage districts, supervised by the County Drain Commissioner.

Number of acres of Carey land filed on: 10,905.13.

Number of acres of Carey land filed on susceptible to irrigation: 9,239.40.

Number of acres of Carey land open to entry: 2,069.86.

Number of acres of Carey land open to entry susceptible to irrigation: 1,140.

Amount of water per acre required to be furnished by Carey Board: One cubic foot per 100 acres per second.

Amount of water per acre actually required by land: Varies according to kind of crops, but not in excess of amount required to be furnished.

Method of measuring water to farm units: By weirs and turn-out boxes.

Method of record of water delivery: Patrolmen required to take daily measurements of water delivered from about June 15 to August 15.

Amount charged per acre for maintenance as per contract with Carey Board: \$1.00 per acre.

Actual cost of maintenance per acre: \$2.00.

BIG TIMBER PROJECT.

The lands embraced in this project lie near Big Timber and the contracting company is the Glass-Lindsay Land Company. The total area of Carey Act Land land within the Project is 11,299.16 acres; total sales of Carey Land is 6,174.94 acres. Total area patented to the State is 7,756.12 acres and the total area patented by the State to settlers is 3,619.32 acres. Amount of land sold under this Project during the past two years is 1,160 acres. Total receipts therefrom are \$1,752.00.

VALIER PROJECT.

This Project embodies a total segregation of 85,420-14 acres of Carey Act land, 56,782 acres of which are irrigable. Total amount sold is 56,433.65 acres of which 43,150.21 acres are irrigable. Total amount sold during the past two years is 22,203.75 acres for which the State received \$33,641.63, from 237 sales averaging nearly 94 acres each.

The State has an application for patent pending before the General Land Office at this time.

Measurements of water supply are being carefully taken on this Project and a number of automatic gages are installed, which are checked by the State Engineer's office as occasion requires.

During the past two years much work has been done toward the ultimate completion of the Project and an exhaustive study of the drainage and seepage problems have been maintained with a view of remedying all such cases.

The statement of the Company up to June 30th, 1918, follows:

ITEMIZED DESCRIPTIVE STATEMENT BY THE COMPANY. JUNE 30th, 1918.

Name of Project: The Valier Project.

Name of Company: The Valier-Montana Land & Water Company.

Post Office Address: Valier, Teton County, Montana.

County in which lands are situated: Teton County.

Description of Location: The Valier Project is situated in Teton County, in Northwestern Montana and extends two Townships North, two Townships South, three Townships West and four Townships East of Valier, Montana.

Topography: The tract lies in a gently rolling prairie-like country, clear of brush and trees, and covered with a heavy sod of blue joint and buffalo grass. The land drains in a Northeasterly direction with a gradient of fifty feet to the mile to the Marias River.

Altitude: The altitude of the irrigable land is between 3,400 and 3,900 feet above sea level by U. S. G. S. Datum.

Soil: The soil throughout the Project is fertile and deep beyond all practical requirements. Canal excavations and wells dug show that in places it attains a depth of nearly 80 feet. It consists of heavy loam in which the proper proportion of lime is large and of clay small. It is easily worked after first breaking and holds water well. The surface soil retains 60 per cent of water when saturated and the subsoil 40 per cent. Owing to the arid climate, the soil is unbleached and unwashed, and has retained an abundance of soluble salts thereby accounting for its high yields under cultivation.

Description of Water Supply: The water supply for this project is derived mainly from Birch Creek, a mountain creek flowing the year around from the east slope of the Rockies and of excellent quality. This creek drains an area of 150 square miles above the Intake Works of the Birch Creek Canal. A short distance upstream from this intake, the Government has maintained a gaging station for a period of eleven years, from 1907 to date. These measurements indicate that all the years, with the exception of 1910 and 1914, have been wet years. The records show further that the season's flow of this stream is not sufficient to take care of the project by direct flow. The Birch Creek Reservoir was consequently adopted as being necessary. The dam impounding this water, called the Swift Dam, is now completed. The flow from Birch Creek is supplemented by the flow of Dupuyer Creek, which has a drainage area of 111 square miles. The joint drainage area is 261 square miles. The waters of Birch Creek are diverted into the Birch Creek Canal at a point 12 miles below the Swift Dam. From that point this canal runs Easternly to Dupuyer Creek and empties into the latter. A short distance from where the waters join, they are diverted into the Dupuyer Creek Canal. The Dupuyer Creek Canal delivers water to both the 'C' Canal and the 'C-3' Canal. The 'C' Canal is for the irrigation of lands which are irrigated from the direct flow of the streams, and the 'C-3' Canal empties into the Lake Frances Reservoir. It is intended to use both normal flow and flood water.

Number of Reservoirs with Area and Capacity of Each:

Two Reservoirs.

1. Birch Creek Canyon Reservoir, area 506 acres, capacity 30,000 acre feet.
2. Lake Frances Reservoir, area 5,536 acres, capacity 112,000 acre feet.

Canals Leading from Streams to Land or Reservoir:

Birch Creek Canal, 14.2 miles long, capacity 700 second feet.

Dupuyer Creek Canal, 3.3 miles long, capacity 900 second feet.

C-3 Canal, which is the feeder for Lake Frances, 2.2 miles long, capacity 900 second feet.

Length of Main Canals from Reservoir Completed: 29.3 miles.

Length of Main Canals from Reservoir to be Built: None.

Length of Main Laterals Completed: 133.7 miles.

Length of Main Laterals to be Completed: 7.8 miles.

Length of Distributing Laterals Completed: 292.0 miles.

Length of Distributing Laterals to be Completed: 6.3 miles.

Total Length of Canals and Laterals Completed: 474.8 miles.

Total Length of Canals and Laterals to be Completed: 14.1 miles.

Attention should be called to the fact that only a very small portion of the canal mileage represents intake canals, while the great majority are distributary canals which reach out in every direction, making a complicated network of laterals to get water within one-half a mile of each and every forty-acre tract.

Character of Construction: The canals and structures on the project are built according to the most up-to-date engineering practices. Most of the canals are built for possible larger capacities in the future, and are of more than ample size to take care of all present and future needs.

Additions and Betterments: Owing to the enormous increase in land sales during 1916, it became necessary to prepare to open for settlement that portion of the project lying in the North-eastern part and known as the "K" system, and a part of that portion known as the "S" System. The canals on these tracts had already been built during the construction period of 1911 and 1912, but all the timber structural work had been deferred until such a time as colonization needs demanded. Consequently this development necessitated the installation of 231,042 board feet of timber, 43,142 cubic yards of earth excavation, including cleaning out canals to put them in proper shape, building relocated canals to serve the settler in the best and most completed manner possible, building proper approaches to bridges, etc., and placing 200 cubic yards of concrete.

The soil on this newly developed portion of the project is of the same general character and of the same fertility as the older settled portions and bids fair to become the source of production of many thousands bushels of grain in the very near future.

Number and Character of Structures: Wherever possible, all structures on the main canals and laterals are solidly built of reinforced concrete. The principal structures on the project are:

THE SWIFT DAM AND AFFILIATED STRUCTURES:

Main Dam—

Character: Arched rock-filled with concrete facing, placed between solid rock walls of Birch Creek Canyon.

Height: 157 feet.

Length of top: 470 feet.

Rise of arch at center: 20 feet.

Width of base: 391.55 feet.

Width of crown: 15 feet.

Upstream slope: 1:1 to 100 foot level, 1.2:1 to 154 foot level and vertical to 157 foot level.

Downstream slope: 1 1-3 to 1.

Foundation: Natural creek bed, sand, gravel and boulders.

Facing:

Area covered: Total width from creek bed to 154 foot level

Thickness: 18 inches thick at creek bed to 8 inches at 154 foot level.

Reinforcement: One-half inch square twisted steel bars, 4 inches from center to center along the slope and 5 inches from center to center horizontal.

Expansion joints: 50 feet center to center and extends from the 50 foot level to top of coping. (159 foot level.)

Cut-off sides of canyon: Facing extends 2 feet into solid rock on sides of canyon.

Coping:

Height: 5 feet, extends vertically from 154 foot level to 159 foot level.

Relation to facing: Connected at top with facing at 154 foot level.

Thickness: From 12 to 24 inches.

Form: Back vertical, face curved.

Purpose: To deflect waves away from fill.

Cut-off Wall:

Relation to facing: Connects with facing at creek bed.

Depth, maximum: From creek bed to 2 feet into solid rock, 33 feet.

Width: 9 feet.

Sides: Entered into solid rock on sides of canyon, 2 feet.

Rock Blanket on Upstream Face:

Relation to facing: Placed over facing from creek bed to 106 foot level.

Height: 106 feet.

Crown width: 17 feet, 6 inches.

Slope on upstream side: 1 1-2 to 1.

Berm at Downstream Toe:

Purpose: To protect downstream toe from erosion by discharge of valves.

Height: 12 feet.

Crown width: 20 feet.

Slope face: 1.1 to 1.

Maximum base width of Dam and Berm over all in feet: 477.75 feet.

Maximum height of Dam from creek bottom to top coping: 159 feet.

Maximum height of Dam from bottom cut-off wall to top coping: 192 feet.

Quantities:

Total number of cubic yards in fill, measured by excavation: 202,614 yards.

Percentage swell of rock measured in fill, over that measured in quarries: 30 per cent.

Total cubic yards of concrete placed: 4,190.9 yards.

Total lineal feet of steel used: 410,311 feet.

Outlet Tunnel:

Character: Driven through solid lime stone rock.

Length: 568 feet.

Width: 7 feet.

Height maximum: 6 feet 5¾ inches.

Form of bottom: Level.

Form of sides: Vertical for 4 feet, 9 1-2 inches, to spring line of arched top.

Form of top: Arched on radius of 4 feet, 6 inches.

Concrete lining: Maximum thickness 9 inches, minimum thickness 4 inches.

Seal between lining and rock: Grout pumped in under a pressure of 125 pounds per square inch.

Regulating Works Outlet Portal:

Four 36-inch Crane valves, tested to 120 pounds pressure per square inch, connected with steel pipe 7 feet in diameter and 1-2 inch thick, which extends into the tunnel and inside of the tunnel lining 100 feet.

Double Trash Rack Upper Portal:

Front rack: Consisting of 20 pound railroad rails placed on a steep slope around the tunnel inlet and held in place by 60-pound railroad rails placed horizontally and connected with the 20-pound rails by yokes and plates manufactured from 3-4 inch material.

Rear rack: Placed adjacent to tunnel portal and inside of front rack, consisting of steel bars 1-2 inch thick by 3 inches wide, set on edge 3 1-2 inches from center to center and supported by heavy concrete foundations and steel eye beams.

Valve House and Outlet Culverts:

The valve house is a re-inforced concrete structure, built into the outlet portal of the tunnel, enclosing the valves and the operating mechanism.

Outlet culvert is double barrel and leads from the valves to the creek bed below the dam, one barrel accommodating the discharge from two valves. Each barrel of the culvert is 8 feet, 6 inches wide and 7 feet high. The walls of the structure are curved downstream so the discharge from the valves may be deflected away from the toe of the dam.

Maximum estimated discharge of outlet works under full head is 2,500 cubic feet per second.

Quantities in Tunnel and Regulating Works:

Cubic yards of solid rock excavation: 2,002 cubic yards.

Cubic yards of concrete: 560.5 cubic yards.

Pounds of metal set: 91,768 pounds.

Sacks of cement used: 4,892 sacks.

Lineal feet of re-inforcing steel used: 7,200 feet.

Earth and Rock Fill Dyke:

Location: 700 feet northwest of main Swift Dam.

Character: Earth and rock fill, resting on solid rock from center to south end and on earth from center to north end.

Maximum height: 40 feet.

Length of crest: 400 feet.

Rock Section:

Upper slope: 13-4 to 1.

Lower slope: 11-3 to 1.

Crown width: 5 feet.

Earth Section (on upstream side of rock section.)

Upper slope: 3 to 1.

Riprap: Upper slope of the earth section is covered with a layer of rock, 2 feet thick, dumped in place. This material was taken from the spillway excavation.

Cut-off Wall:

Concrete cut-off wall is 6 feet high, being 12 inches wide at the top and 24 inches wide at the base. This wall extends two feet into solid rock or 6 feet into the earth, depending upon the character of the foundation encountered. It is located well within the earth portion of the structure.

Quantities Placed in Dyke:

Cubic yards of solid rock excavation: 13,150 cubic yards.

Cubic yards of earth excavation: 18,453 cubic yards.

Cubic yards of concrete: 153 cubic yards.

Square yards of riprap: 4,361 cubic yards.

Sacks of cement used: 917 sacks.

Spillway:

A concrete lined spillway, having a total length from the upstream end of the spillway lip to the outlet end of the channel of 762 feet and a bottom width of 18 feet, with slopes of 1-2 to 1, to a vertical height of from 12 feet, 3 1/2 inches at the downstream end of the spillway lip, to 10 feet, 4 1/4 inches at the outlet end, was originally constructed to pass the excess water over and above the reservoir capacity of 30,000 acre feet.

Quantities Moved and in Original Spillway:

Cubic yards of solid rock excavation: 13,150 cubic yards.

Cubic yards of concrete: 969.5 cubic yards.

Sacks of cement used: 4,469.0 sacks.

Square feet of wire mesh used: 7,515 square feet.

In 1917 an enlargement of this spillway was planned and construction activities started immediately. This enlargement necessitated the excavation of 25,396 cubic yards of rock. This wasteway has an average bottom width of 60 feet, the enlarged portion being unlined. The length of the actual spillway lip is 395 feet and is at an elevation of 147 feet above the creek bed, or at an elevation representing the maximum storage capacity of the reservoir, or 30,000 feet. The computed discharge of the spillway is 8,000 cubic feet per second with a depth of water over the lip of 4 feet, or an elevation of water surface of 151 feet above the creek bottom. The cost of this enlargement was \$26,660.00.

Quantities to Date Moved and in Work:

Cubic yards of solid rock excavation: 38,546 cubic yards.

Cubic yards of concrete: 969.5 cubic yards.

Sacks of cement used: 4,469.0 sacks.

Square feet of wire mesh used: 7,515.0 square feet.

Summary of Quantities of Rock, Earth and Material Moved and Placed in the Swift Dam and Affiliated Structures, the Spillway and Rock Fill Dyke:

Solid rock excavation: 243,481 cubic yards.

Loose rock, excavation for cut-offs, etc., not included in above detail: 802 cubic yards.

Earth excavation (includes 2,699 cubic yards for cut-offs, surface ditches, etc., not included in above detail): 21,152 cubic yards.

Total cubic yards of material moved on contract prices: 265,435.

Estimated cubic yards of earth, loose rock and solid rock taken from cut-off wall of main dam:

1,200 cubic yards.
 Grand total of materials moved and placed in the structures (equivalent to 5,804,644 bushels):
 266,635 cubic yards.
 Square yards of riprap placed (taken from Spillway): 4,360.6 cubic yards.
 Cubic yards of concrete placed: 5,873.9 cubic yards.
 Total number of sacks of cement used (would reach 13.9 miles if placed end to end): 36,688 sacks.
 Total number of lineal feet of $\frac{1}{2}$ inch square twisted re-inforcing steel used (would reach 79 miles if placed in one line): 417,311.10 feet.
 Square feet of triangular wire mesh used: 7,515 square feet.
 Pounds of metal set: 91,768 pounds.
 Total tonnage hauled from Valier to Swift Dam site, 34 miles: 2,026.36 tons.
 Total cost of Swift Dam and affiliated structures: \$522,291.09.
 Total acre feet of water impounded: 30,000.
 Cost of storage per acre foot: \$17.41.
 Period of time structures have been in operation, January 4th, 1915, to date, June 30th, 1918: Three years, 5 months, 27 days.
 Maximum recorded height of water of reservoir above creek bottom: 153.5 feet.
 Maximum depth of water recorded passing over spillway lip: 6.5 feet.
 Maximum discharge through spillway, feet per second on June 22nd, 1916: 4,713 second ft.
 Maximum seepage measured from under main dam with 134 feet of water in reservoir on January 11th, 1916: 4.88 cubic feet per second.
 Maximum settlement to date, measured on top of coping on June 30th, 1918: 2.15 feet.
 NOTE—The spillway as enlarged and completed in 1918 has a computed carrying capacity of 8,000 cubic feet per second.

LAKE FRANCES DAM:

An earth dam, 40 feet high and 600 feet long on top, with re-inforced concrete core wall and double 53-inch barrel tunnel outlet, with concrete gate tower.

LAKE FRANCES DYKE NO. 1:

An earth dyke, partially completed, being 6,230 feet long on top with a maximum height of 20 feet, a crown width of 12 feet, an outside slope of 1 1-3 to 1, and an inside or water slope of 3 to 1. 70,000 cubic yards is the estimated quantity necessary to complete the structure.

LAKE FRANCES DYKE NO. 2:

A small earth dyke on the north shore of Lake Frances at the eastern boundary of the town-site of Valier. This dyke is 725 feet long, with a maximum height of 4 feet, having a volume of 1,738 cubic yards of earth. Construction will start in 1918 and when dykes Nos. 1 and 2 are completed, Lake Frances Reservoir will hold its computed capacity of 112,000 acre feet of storage.

BIG FLAT COULEE SIPHON:

This siphon consists of 929 feet of concrete pressure pipe, 7 feet in diameter and 2,918 feet of wood stave pipe, 78 inches in diameter with concrete intake and outlet structures. The wood stave pipe is under a 150.3 foot head at the lowest point of the coulee and has a capacity of 360 second feet.

BIRCH CREEK DIVERSION DAM:

This diversion dam is located on Birch Creek about 12 miles below the Swift Dam and is used for diverting water into the Birch Creek canal. This consists of a re-inforced concrete gate structure, 50 feet, 6 inches wide, containing 6 steel gates at the gate openings, each 4 feet by 6 feet. The elevation of the bottom openings is 4,170.7 feet. In addition to this, the structure has a section 18 feet long, containing what is known as the prior right gate, which has been constructed to allow the required amount of prior right water appropriations to pass along the creek. This gate opening is 4 feet by 6 feet, the 18 foot section containing also a sluice gate 4 feet by 6 feet, the bottom of which is on the level with the floor of the structure and constructed in this manner so that all sediment lodging in the structure may be flushed out.

There is also an earth dyke at this location, 1300 feet long, having a crown width of 6 feet, an inside slope of 2 1-2 to 1 and an outside slope of 1 1-2 to 1. This dyke has a top elevation of 4,180 feet, which is the elevation of the top of the headgate structure. The maximum height above the ground surface is 7.4 feet. This dyke was constructed so that in time of maximum flood in Birch Creek, when the water is estimated to go over the diversion weir at a depth of 4 feet, the valley on the south side of the "B" canal will not be flooded.

The diversion weir itself is a cyclopien concrete gravity section, being 384 feet long and 2 1-2 feet wide on top. The water side is vertical and the downstream side is on a slope of 2-3 to 1. The elevation of the top of this diversion weir is 4,175 feet and is 8 feet above the creek bed. The base of the weir section is 8 feet and a cut-off is constructed at the upstream and downstream edges of the base. These cut-offs are carried down into impervious material.

The downstream floor or apron, upon which the water falls, is 19 feet, 6 inches, long and is 1 foot thick. Another cut-off wall is constructed at the end of this apron to prevent back-scour under the floor. The elevation of the floor is 4,167.0 feet.

The total cost of the diversion weir, headgate, earth dyke, etc., is \$53,000.00.

CONCRETE AND TIMBER DROPS ON THE BIRCH CREEK AND DUPUYER CREEK CANALS:

On the Birch Creek canal there are two re-inforced concrete drops, one a 5-foot drop and the other a 11-foot drop, both of a capacity of 700 second feet. About 80 feet of excess grade in the Birch Creek canal is taken up by 35 2 1-2-foot combination concrete and timber drops, and in the Dupuyer Creek canal there are 6 of these drops. These drops are constructed of heavy timber aprons and floors, with concrete wing walls.

DUPUYER CREEK DIVERSION WEIR AND HEADGATES:

A concrete diversion weir of the ogee type on a gravity section is constructed across Dupuyer Creek. This weir is 196 feet, 5 inches, long and 7.8 feet high. The gate structure is of re-inforced concrete and contains 6 gate openings, each 7 feet, 9 inches, by 5 feet 2 inches. Five of these discharge into the canal and one is used as a wastegate to discharge back into the creek. The capacity of the Dupuyer Creek canal is 900 second feet, 700 of which is supplied by the Birch Creek canal and 200 of which is supplied by the waters of Dupuyer Creek.

Drops:

In constructing drops on the project, a system has been followed of using re-inforced concrete in all canals of a capacity of 20 cubic feet per second or over and timber is used in all canals of less than 20 cubic feet per second capacity.

Turnouts:

All turnouts from main canals and main laterals which have a capacity of 60 cubic feet per second or more are built of concrete entirely, or of vitrified salt glazed sewer pipe with a concrete head wall and wings on both intake and outlet ends. Turnouts from canals of less than 60 second feet capacity are constructed of timber entirely or vitrified salt glazed sewer pipe with timber head wall and wings.

Checks:

On the majority of the distributing laterals, there is a check at every turnout, except in those places where turnouts are close together. The nature of the material used for checks is governed by the capacity of the canal in the same manner as drops. There are four different designs that have proven effectual in operation: The large concrete check, the concrete 'low head' check, the large timber check and the small timber sloping side check.

Timber Drops:

Several designs of timber drops have been installed, but the design which has so far proven the most efficient is constructed with a water cushion and vertical curtain wall, built across the top and extending down into the water cushion so as to form a well and cause the water to flow out from under the bottom of the curtain wall and raise up against the water ponded in the cushion compartment. This very materially checks the velocity and retards the tendency to cut back after leaving the apron and coming into contact with the earth section. There are about 1,000 checks, drops, division boxes and rating flumes on the project.

Bridges:

About 450 bridges have been constructed on County and other roads. They were designed according to State and County regulations to carry a 15-ton traction engine or a distributed load of 20,000 pounds.

Total Acreage Within the Boundaries of the Project: 165,537.74 acres:

Carey: 72,359.63 acres.
Company deeded: 56,811.68 acres. (Includes 12,552 shares of Pondera Stock.)
Private: 28,442.43 acres.
State: 7,924.00 acres.

Total Acreage to Be Actually Irrigated by Project: 85,258.00 acres.

Sales:

Total Carey acreage filed on: 54,131.42 acres.
Carey acreage filed on susceptible of irrigation: 40,582.21 acres.
Total Company Deeded acreage (exclusive of Pondera land) sold: 39,141.64 acres.
Company Deeded acreage (as above) susceptible of irrigation: 18,012.57 acres.
Total acreage sold to date: 93,273.06 acres.
Total irrigable acreage sold to date: 58,594.78 acres.
Pondera Stock applied: 11,686.13.
Total acreage calling for water delivery: 70,280.91 acres.
Total Carey acreage open for entry: 18,228.21 acres.
Carey acreage irrigable open for entry: 13,197.00 acres.
Total deeded acreage unsold: 5,118.04 acres.
Deeded acreage irrigable unsold: 2,360.68 acres.
*71,898.79—Actual total figure which equals 70,280.91 plus 752.0 shares applicable to lands other than Company land plus 865.87 shares Pondera Stock unapplied as yet but sold and liable for water delivery.

Total Estimated Cost of Project: \$4,257,457.09.

Total Expenditures to June 30th, 1918: \$4,132,457.09.

Price of Water Right Per Acre for Carey Lands: \$50.00 to \$60.00.

Price of Water Right Per Acre for Company Deeded Lands: \$50.00 to \$65.00.

Price of Water Right Per Acre for Other Than Company or Carey Lands: \$50.00 to \$65.00.

Water Rental Per Acre Per Season on Lands Other Than Company Lands: \$4.00.

(NOTE—Only that water which would be applied to unsold Carey and Deeded lands can be rented. Rental ceases when all lands are sold, unless a surplus exists.)

Terms of Payments on Water Contracts:

A charge of \$5.00 per acre is made at the time of purchase, the balance being paid in 14 equal annual payments with interest at 6 per cent on deferred payments.

What Necessities for Drainage System Have Arisen?

Wastewater from ends of canals which do not terminate in natural coulee drainage is being taken care of. Also there are about 230 acres comprising small pieces of seeped lands scattered about the project, no one piece being larger than 25 acres in area, and a good many of which are being farmed this year.

What Character of Drainage Has Been Adopted and to What Extent in Actual Construction:

About 6 miles of waste ditches have been constructed from ends of canals to coulees. No trouble is encountered after reaching the coulees. Plans have been drawn for wasteway chutes from the ends of canals which are impractical to continue to coulees on a canal gradient. These chutes will carry the water down the banks of coulees into stream beds. Test holes have been drilled with a core drill on all the important seepage areas and observation are being made of the fluctuation of the water table, the character of the water bearing strata and the velocity of the underground water. Detail topography of the surface has been taken and plotted up, the same plat showing the topography of the water table and on some tracts paper locations of tile drain systems have been made.

Amount of Water Per Acre Required, by Carey Board to Be Furnished:

18 inches.

Amount of Water Per Acre Actually Required by Land: Not definitely determined.

Method of Measuring Water to the Farm Units:

The Australian water meter has been determined as the most simple and permanent device to measure farm deliveries, principally owing to the great variation in fall or slopes of farm ditches, which in turn is due to the fact that under such a vast distribution system a great variation in topographical conditions is found, and the necessity of standardization in measuring devices is ever a potent factor in successful operation. Cippoletti and rectangular weirs and submerged orifices are now used in various places, but owing to the fact that the Australian Water Meter may be operated under a very small loss of head and is adopted to almost any location, they will be installed, as time permits, as the standard measuring device.

Method of Record of Water Deliveries:

Written application for water is made by users on blanks furnished by the Company. These blanks are left in tin boxes on user's headgates and are taken up by the Assistant Water Master or Ditch Riders and sent to the Water Master's office together with the Rider's report of delivery. The same method is pursued in shutting off water, the Rider using in addition a special report showing any changes or interruptions in flow of water from the original report. The combination of these reports dates time and amount of water used. All records are kept by name and description of the land. Certified summary of deliveries are made monthly by the Assistant Water Masters.

Amount Charged Per Irrigable Acre for Maintenance, as Per Contract With State: \$0.50.

ACTUAL COST OF MAINTENANCE PER ACRE FOR YEAR OF:

1912.	1913.	1914.	1915.	1916.	1917.
\$0.48	\$0.95	\$0.92	\$0.92	\$0.90	\$1.99

NOTE—The figure of \$1.99 represents the actual cost of maintenance work for 1917, and is derived from dividing the total maintenance charges by the number of irrigable acres sold bringing in maintenance payments of \$0.50 per acre. This figure should be distributed over the preceding years from and inclusive of 1913, owing to the fact that maintenance work during this period of years was neglected and only a very small amount of work having been done. Consequently the burden fell upon the year 1917.

TETON PROJECT.

This Project lies near Brady and is situated between the Valier Project and the Sun River Project of the U. S. Reclamation Service and has practically the same condition of soil and topography.

A segregation of 34,166-60 acres has been made under the Carey Land Act, and while the final approval is still pending, considerable amount of construction has already been done.

Continuous stream measurements are being maintained by the State Engineer's Office to ascertain the available water supply that may be depended upon over a period of years and as soon as the approval of the Project is had from the Federal authorities, it will be pushed to an early completion.

The statement of the Company follows:

REPORT ON THE TETON PROJECT.

Name of Project: The Teton Project.

Name of Company: The Teton Co-Operative Reservoir Company.

Postoffice address: Helena, Montana.

County in which land is situated: Teton and Chouteau counties.

Description or location of lands:

Altitude 3500 feet above sea level.

Topography: Gently rolling land, sloping northeasterly about 25 feet per mile.

Soil: Generally a sandy loam and it is of fine quality.

Description of water supply:

Teton River and Muddy and Blackleaf Creeks.

Running water, later stored in the Auxiliary Reservoir, is taken from Muddy and Blackleaf Creeks.

Water from the Teton River is stored in the Bynum Reservoir.

Capacity of Bynum Reservoir: Approximately 80,000 acre feet.

Capacity of the Auxiliary Reservoir: 3,500 acre feet.

Canal leading from the Teton River to the Bynum Reservoir is about 4 miles long, and its capacity will be 800 second feet. This is partly completed so that water is stored in the Bynum Reservoir each year.

Length of Main Canal from Reservoir, Completed: None.

Length of Main Canal from Reservoir to be Built: 28 miles.

Total Length of Canals and Laterals When Completed: Unknown, as the location surveys for the laterals have not yet been made.

General Description of Project:

Character of Construction: Canal is generally through earth with occasional spots of gravel and hardpan.

Number and Character of Structures: One metal flume, 145 inches diameter. Two concrete siphons, 84 inches internal diameter, each about 400 feet long. Twenty concrete drops and chutes with total fall of 260 feet. No other engineering difficulties to be overcome.

Total Expenditures to October 31st, 1918: About \$400,000. During 1917 and 1918 this Company placed a self-recording gauge height instrument at the Headworks on Teton River, purchased many Rights of Way tracts between Muddy Creek and the Auxiliary Reservoir, together with the greater part of the land required for the latter reservoir and made Location Surveys from the Auxiliary Reservoir to the land to be reclaimed.

Price of Water Rights for Carey Lands: Probably not less than \$50 per acre.

Price of Water Rights for Lands Owned by the Company: Company has no lands other than the Carey Lands.

Terms of payment on Water Contracts: Not yet determined.

Total Number of Acres Within the Boundaries of the Project: About 34,000.

Total Number of Acres to be Actually Irrigated: About 30,000.

Number of Acres of Carey Land Open for Entry: None.

Amount of Water Per Acre Required to be furnished by the Carey Board: One and one-half acre feet per acre irrigated.

Amount of Water Per Acre Actually Required by Land: Not to exceed 1 1-2 acre feet per acre.

Method of Measuring Water to Farm Units: Not as yet determined.

It is the intention of this Company to prosecute this work with diligence as soon as conditions reach their normal or nearly so and to get the land in this segregation on the market as soon as possible.

The years 1917 and 1918, being very dry ones, show conclusively that irrigation is necessary in the vicinity of this Segregation No. 10, if good crops are to be assured the farmers, and those in this vicinity recognize this fact and have made application for the first privilege of purchasing tracts adjoining their farms.

This project, when completed, will add a large tract of irrigated lands to the area of Teton and Chouteau Counties which will materially increase their assessed values and when settled, will add about 200 families to the population.

FLATWILLOW PROJECT.

This Project is located southeast of Lewistown in eastern Fergus, and is comprised of 7,768.80 acres under the Carey Act and has been approved by the Secretary of the Interior. The Contracting Company has been seriously handicapped in financing the work on account of the War, but is now rapidly getting into shape to begin the actual work of construction in real earnest.

Measurement of stream flow is being maintained by the State Engineer's Office to ascertain the actual water supply available over a period of years.

The statement of the Company follows:

Statement of the Fergus County Land & Irrigation Company's Project, Commonly Known as the Flatwillow Project.

The last report on the status of this project and progress of construction was submitted under date of November 29, 1916. The board of directors of this company immediately after rendering this report, realizing the necessity of actively prosecuting the work of completing the project with the greatest possible vigor, began laying plans for further financing construction and completion.

A contract for ditch building was entered into and a section of the company's main distributing canal was built during the latter part of the season of 1917 and the early part of January, 1918, described as beginning at the intersection of the company's principal distributing canal with Pike's Creek down the course of this canal to the intersection of the canal with the east line of section 36, in township 13 north, of range 25 east of the Montana Principal Meridian, a length of approximately two and one-half miles, containing a yardage of earth moved of approximately 25,000 cubic yards.

The work was begun after submission of contract and specifications to your honorable body and upon approval of plans submitted. The State Engineer, Mr. A. W. Mahon, Secretary of your board, had frequently expressed doubts as to the advisability of constructing the proposed reservoir dam at the proposed site for reasons appearing sufficient to him from an engineering standpoint, an important reason being in his estimation lack of sufficient quantities of good material for the construction of dam within reasonable distance from the proposed site.

Acting upon Mr. Mahon's suggestion, the vice-president and secretary of this company were detailed by its board of directors to make an extended trip during the winter of 1918 to the irrigated districts of the West for the purpose of familiarizing themselves with high earth dam construction elsewhere. These officers visited many of the largest irrigation earth dam structures and got in touch with Mr. Adelbert F. Parker, an experienced irrigation engineer of Ogden, Utah, and negotiated with him for a report on the proposed damsite and alternative suggestions should the proposed site not meet with his approval.

In the spring of the present year, Mr. Parker visited the project, made test borings of the strata underlying the proposed dam, investigated the material in the immediate vicinity etc., and submitted a report, the substance of which is to the effect that while an earth dam satisfactory in character can be constructed at the proposed site, the cost would be high. A copy of this report has been furnished your honorable body.

Mr. Parker examined another reservoir and damsite on Flatwillow creek. Lack of time prevented his making a thorough investigation at the time. Mr. Parker returned during the fall for the purpose of more extended observations and preliminary surveys of the new proposed reservoir and damsite. Your Mr. Mahon was advised of his arrival here and made a trip to the project for the purpose of forming his own opinion of the main features. Mr. Parker is at present at work compiling his report which this company expects soon to receive. Mr. Parker's oral statements, both on the occasion of his first examination of the new proposed damsite and on the occasion of his recent trip here, are to the effect that he regards the new proposed damsite from many points of view as an ideal one, presenting innumerable advantages over the old proposed site.

There has been spent approximately \$14,000 during the last two years in construction of ditch, engineering work, surveys, overhead and incidental expenses. The above is a brief summary of the work accomplished during the period reported on.

In addition it may be of interest to note that Mr. Parker, whose knowledge of irrigation matters is wide, entertains a very high opinion of the possibilities of the Flatwillow project and of its future.

The hydrographer's station established on Flatwillow creek to measure the water discharge in that stream continues its observations.

It is believed that Mr. Parker's report on the new proposed damsite will determine this company in favor of the new site. As the new site is on Flatwillow creek this will enable the company to store not only the recorded or summer flow of Flatwillow creek, or so much of it as belongs to this company, but also the unobserved or winter flow as no question of leading water through an intake canal during the winter will arise at the new site. It is fair to assume that from fifteen to twenty thousand acres may be successfully irrigated by this project with the building of a reservoir on the Flatwillow bottoms, which will mean converting a very indifferent dry farming country into a highly productive, intensively farmed irrigated section. This will spell wealth and prosperity for eastern Fergus County, where dry land farmers are at present eking out a precarious existence because of lack of dependable rainfall.

LITTLE MISSOURI PROJECT.

This project comprises an approved segregation of 20,607.98 acres under the Carey Land Act lying in the Valley of the Little Missouri River in the southeastern part of Carter County.

Stream measurements are being maintained on the Little Missouri River by the State Engineer's Office to ascertain the flow for actual water supply available over a period of years. In addition to the Little Missouri River waters, an auxiliary supply will be available from the run-off of Cottonwood Creek, upon which the reservoir site is located, but this supply consists only of flood waters.

The Company has been handicapped in its finances by the War, but appears to be getting into proper financial condition at this time to push the project to completion.

Their statement follows:

Statement of Little Missouri Land & Irrigation Company.

In compliance with the requirements of your Board for a statement of the operations of the Little Missouri Land and Irrigation Company during the past two years we beg to submit the following report:

The Project of the Little Missouri Land and Irrigation Company, known as Segregation Number 22, embracing an area of 20,607 acres, is situated upon the Little Missouri River in Carter County, Montana. The owner of the Project is the Little Missouri Land and Irrigation Company, a corporation organized under the laws of the State of Montana.

The lands embraced within this Project lie along the West side of the Little Missouri River, at the extreme southeast corner of the State of Montana, with a reservoir site on Cottonwood Creek at a point about two miles from its junction with the Little Missouri River. This river forms the southern and eastern boundary of the tract.

The detailed statement of the project submitted your Board under date of December 1st, 1916, gives all the information regarding the Project and there is no change in the conditions since that date. All the construction contracts entered into by the Company have been settled in full and further progress has been delayed owing to the financial conditions brought about by the War.

The conditions in that part of Montana during the past two years have demonstrated the necessity of reclaiming land by irrigation for the purpose of furnishing winter feed for the livestock raised there and it is apparent that an immediate demand for the land would be created by the completion of the Project. Non-irrigated crops in that section of the State have suffered from lack of moisture during both years and have been just short of a complete failure.

With the resumption of normal business conditions it is believed that, upon the completion of this Project, the proposed railroad from Belle Fourche, South Dakota to Miles City, Montana, would be constructed, which would not only greatly benefit that particular portion of the State, but would also bring one of the large railroad systems in direct connection with Montana.

Prices of land in the Middle West are constantly advancing and there seems to be a demand for desirable farm land, even during these war times, which we believe will steadily increase after the ending of hostilities.

Every effort will be made to make the land under this Project available to settlement at an early date.

SUMMARY OF PROJECTS.

	Acres.
Billings Project, approved list No. 1.....	10,472.88
Big Timber Project, approved list No. 2.....	7,829.84
Big Timber Project, approved list No. 3.....	400.00
Billings Project, approved list No. 7.....	2,750.66
Valier Project, approved list No. 8.....	60,301.41
Big Timber Project, approved list No. 9.....	1,360.00
Teton Project, pending list No. 10.....	34,166.60
Big Timber Project, approved list No. 11.....	1,709.32
Valier Project, approved list No. 12.....	3,596.58
Valier Project, approved list No. 14.....	21,522.15
Flatwillow Project, approved list No. 21.....	7,768.80
Little Missouri Project, approved list No. 22.....	20,607.98
Total.....	172,486.22

Relinquishments.

List 7 of Billings Project.....	611.09
List 8 of Valier Project	120.00
List 10 of Teton Project	40.00

Total.....	771.09
Amount segregated according to Seventh Biennial Report.....	173,257.31
Amount relinquished or canceled during the last two years.....	771.09

Total amount segregated November 30, 1918.....	172,486.22
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Approved Carey Land Sales.

Billings Project	10,859.62
Big Timber Project	6,174.94
Valier Project	56,433.65

Total.....	73,468.21
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United States Patents Issued to State of Montana.

On Billings Project	13,223.54
On Big Timber Project	7,756.12

Total.....	20,979.66
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Patents Issued to Settlers by the State of Montana.

On Billings Project	8,194.66
On Big Timber Project	3,619.32

Total.....	11,813.98
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